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Influence of subducted morphostructures on the segmentation of the upper plate : example of the Coral Sea Basin, Papua New Guinea

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The Coral Sea Basin propagator, offshore Papua New Guinea, opened through the Australian margin and partially isolated a crustal block of continental nature, the so-called Southern Papuan Block. Part of this crustal block is already subducted underneath Papua New Guinea. Inland topography and morphostructures of the Southern Papuan Block suggest a segmentation of the margin. Herein, we specifically discuss the effect of the segmentation of the lower plate on the upper plate. A new tectonostratigraphic model, based on the recognition of three megasequences, is proposed by correlating 2D seismic lines together with selected industrial drillings, topographic, gravimetric and scarce magnetic data.

Several disconnected rifted basins separated by a number of structural highs characterise the rifted margin north of the oceanic crustal domain. Extension most likely occurred discontinuously during the Upper Jurassic to Lower Palaeocene times, resulting in several, although poorly dated, extensional events. Two to three stages are usually recorded in most basins. The first stage results in the identification of several, small (10km or less) tilted blocks bounded by normal faults. During the second stage, extension reactivated the largest of these faults. Finally, a last moderate rifting stage is observed with thin late synrift sequences. From a basin another, resulting rifted sequences show significant internal seismic architecture variations. They are usually separated by undeformed, post-rift strata of various thickness, implying several unconformities. These variations illustrate disconnected sub-basins which may have opened at different times or coevally. The correlation of rift-related sequences with onshore series is also unclear.

Thick post-rift sequences deposited above. Regionally, they vary according to topography and subsidence processes. A first post-rift megasequence is observed in the deepest parts of the basin but may only appear as localised pockets in the Papuan Gulf. Indirect stratigraphic correlation from wells suggests an Oligocene age. Topward, they are bounded by a regional erosional unconformity sometimes topped by localised, Miocene, carbonates mounts developed on remnant structural highs. These are overlain by widespread clastic sediments. Several other post-rift packages bounded by characteristic unconformities and disconformities are interpreted in the entire succession. Their extent on the continent indicates an overall Miocene-Pliocene age.

A final tectonic event is recorded in the northernmost part of the basin, where the post-rift sediments are included in the south Papuan accretionary complex. It actually consists in two different wedges developed from Pliocene to Recent times. These features may be correlated to the onshore mountain belts geology.

In this study, we discuss the effect of the segmentation of the subducted rifted crust on the along-strike variation of the morphology of eastern Papua New Guinea. It is believed to have strongly influenced the stratigraphic architecture of the margin during all its evolution. This overall architecture of the northern Coral Sea Basin enables the construction of an early structural nomenclature based on the recognised tectonic features and basin infills. The Coral Sea Basin is therefore very comparable to other Asian basins such as the South China Sea.